VALUE CHAIN ANALYSIS OF THE EGYPTIAN AQUACULTURE SECTOR

Ahmed Nasr-Alla[1], Graeme Macfadyen[2], Malcolm Dickson[1],
Diaa Al–Kenawy[1], Mohamed Fathi[1], Gamal El-Naggar[1]

[1]The WorldFish Center, Abbassa, Abou Hammad, Sharkia 44662, Egypt.
[2]Poseidon Aquatic Resource Management Ltd, 308 Rue d'Arbere, Divonne les Bains, 01220, France

Corresponding Author:
Ahmed Nasr-Alla
Tel: +20 10200 43126
Email: a.allah@worldfishcenter.org
Postal address: PO Box 1261, Maadi 11728, Cairo, Egypt

ABSTRACT

Egypt's aquaculture production (921,585 tonnes in 2010) is by far the largest of any African country and places it 11th in terms of global production. Despite the fact that the aquaculture sector in Egypt is now a mature one having developed over a period of more than 30 years, the economic performance of the sector is not well understood or documented. To help improve this understanding WorldFish Centre conducted a value-chain study for the sector in September 2011. The study completed individual interviews and focus group discussions with fish farmers, traders/wholesalers, and retailers in four of the most important governorates in terms of aquaculture production: Kafr el Sheikh, Behera, Sharkia, and Fayoum. The study mapped the value-chain, and generated a wide range of quantitative data for each link in the value-chain on operational and financial performance (e.g. gross output values, variable and fixed costs, operational and net profit margins, value-added generation), and on employment creation (by gender, age and full-time/part-time). Qualitative information on the critical factors impacting on the performance of each sub-sector of the value-chain was also collected, and this enabled recommendations to be made about necessary actions both by those within the value-chain and by those outside of it (i.e. government), to improve value-chain performance. The study showed how value-chain analysis can be a useful tool to describe sector performance and to make evidence-based recommendations for improvements.

Keywords: Value-chain analysis, Egypt, aquaculture

INTRODUCTION

Egyptian fish production is sourced from capture fisheries (inland and marine) and aquaculture. Total fish production increased from 724,300 tonnes in 2000 to 1,304,794 tonnes in 2010. These increases were primarily obtained from significant increases in aquaculture which represented 70% of total production in 2010 compared to 47% in 2000 [1].

Total aquaculture production in Egypt reached 919,585 tonnes in 2010 with a total market value of USD 1,546 million. Egyptian aquaculture is the largest of any African country, and ranked 11th in terms of global aquaculture production [2]. Eighty-five percent of aquaculture production comes from earthen ponds, with the rest produced in fish cages, rice fields and intensive farms [1]. Aquaculture production is strongly concentrated in low lying land around the northern lakes (Manzala, Brulous, Edko and Maryout). According to official statistics, tilapia accounted for 55.5% by volume of aquaculture production in 2010, mullets 29.9%, carp 10.5%, African catfish 2.5%, and European seabass and gilthead seabream 1.5% [1].

Although the aquaculture sector in Egypt is now mature, having developed over several decades, the financial and social performance of the sector is not well understood or documented. Value-chain analysis is potentially a useful tool to address this gap. It has become increasing prominent as a form of analysis in the fisheries and aquaculture sectors [3, 4]. The increasing interest in value-chain analysis is due to the fact that it provides an excellent means to:

- assess the relative importance of factors affecting competitiveness, and the costs and earnings of those involved in the value chain;

- focus on distributional issues and pro-poor and gender equitable growth [5,6,7], and on global linkages in the context of globalization;
- benchmark changes over time;
- identify gaps/weaknesses in value chain performance; and to
- identify 'levers' and targeted action programmes to 'upgrade' and improve value chain performance.

A value chain is a sequence of related enterprises conducting activities to add value to a product from its primary production, through its processing and marketing to the final sale of the product to consumers. The functions of each link in the chain involve sourcing inputs, making/producing, and then delivering/selling product to the next link in the chain. Value chain analysis seeks to understand and describe the enterprises involved in the value-chain and their financial performance [8].

Value chain analysis was first popularized by Michael Porter in the mid-1980's [9], and forms of analysis with many similarities have been undertaken since then by others [10] on value-streams, and [11] on power relations in value-chains. However, it is only more recently that value chain analysis has become increasingly mainstream in development circles.

An important component of value-chain analysis is the recognition that support and action for improving performance throughout the value chain can be achieved both by those within the value chain itself such as private sector operators, and by those outside it including governments and other parties external to the value chain.

This paper presents the outputs of a value-chain analysis completed during September 2011. The research was funded by the Swiss Agency for Development and Cooperation (SDC) as a preliminary study leading to a project proposal for a three-year aquaculture development project; Improving Employment and Income through Development of Egypt's Aquaculture Sector, the IEIDEAS project.

The objectives of the study were to better understand, and document, the pond fish farming value-chain in Egypt. In particular the study aimed to:

- map the value-chain for pond farmed fish to describe the main stakeholders and the flow of product through the value-chain;
- understand the costs and earnings profiles and financial performance of the different sub-sectors/links of the value-chain, and compare the financial performance of the sub-sectors in four regions of Egypt (governorates);
- consider the employment generated by the sector; and
- identify the key constraints and problems impacting on different actors in the value-chain.

MATERIALS AND METHODS

The study was based on collecting production and financial information from 2010 and was limited to pond farming (which accounts for 85% of the total Egyptian aquaculture production) in four governorates, which together account for 74% of total national production from ponds; Kafr el Sheikh, Behera, Fayoum and Sharkia. Figure 1 shows the geographical distribution of the study areas across the country.

The mapping and financial analysis of the pond farming value-chain started at the fish farm and ended with retail sales to consumers. Fish seed was viewed as a farm input along with other key inputs such as fish feed, labour, capital etc. The study was also limited to the retail sector, and did not cover the food service sector.

Two detailed study questionnaires covering both qualitative and quantitative issues were drafted, for fish farmers, and the post-harvest sub-sector (traders/wholesalers and retailers). They were then piloted with a fish farmer and a fish trader/wholesaler which resulted in small changes to the questionnaires, before being finalised and printed.

Individual interviews and focus group discussions were held with fish farmers, traders/wholesalers, and retailers. In order to maximise the number of interviews, small groups of stakeholders met at a central location in each governorate. This provided an opportunity to introduce the study and to hold a focus group discussion in plenary before individual interviews were then conducted with the participants. The number of interviews per governorate was decided on stratified basis according to the available statistics on the number of farms in the target governorates. The introductory comments and focus group discussions, which concentrated mainly on key stakeholder problems and potential solutions, generally lasted around sixty to ninety minutes, as did the individual interviews. Table 1 provides information on the number of individual questionnaires completed in each governorates and the number of participants at the same meetings that were involved in the focus group discussions.

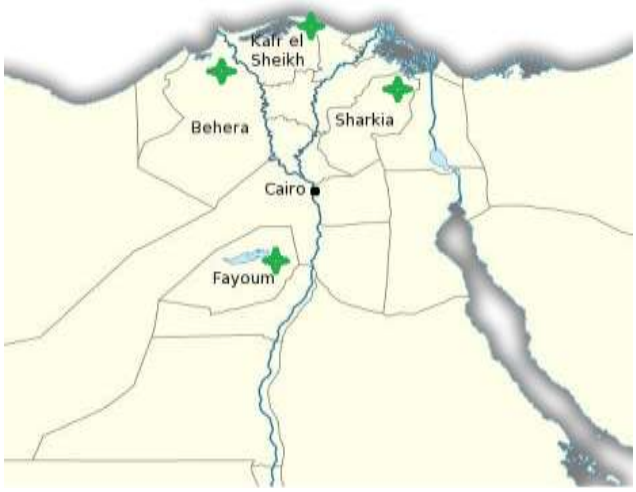

Figure 1. Geographical distribution of study areas

Data obtained from the questionnaires were entered into a Microsoft Excel spreadsheet and analyzed to generate the results which were considered in light of, and informed by, the qualitative focus group discussions.

The data collected during the study have allowed the estimation of a number of key indicators for each link in the value chain. The indicators were calculated both separately for each of the four governorates by taking averages of the data provided by the respondents in each governorate, and for the sample frame as a whole.

Table 1: Sample frame used during the study

Governorate	Fish Farmers	Fish Traders and/or Wholesalers	Fish Retailers
Kafr el Sheikh	22 individual questionnaires 3 focus groups (total of 24 participants)	6 individual questionnaires 1 focus group (8 participants)	5 individual questionnaires
Behera	14 individual questionnaires 1 focus group (15 participants)	5 individual questionnaires 1 focus group (9 participants)	-
Fayoum	16 individual questionnaires 1 focus group (29 participants)	4 individual questionnaires	7 individual questionnaires
Sharkia	9 individual questionnaires 1 focus group (12 participants)	6 individual questionnaires	1 individual questionnaire
Totals	61 individual questionnaires 6 focus groups (total of 80 participants)	21 individual questionnaires 2 focus groups (total of 17 participants)	13 individual questionnaires

The financial indicators calculated included: gross output values per kg; operational profits (sales value-operational cost) in Egyptian Pounds (LE) per tonne of fish (LE1=$5.96) and as a percentage of sales; net profits (revenue- (operational + fixed cost)) in LE per tonne of fish produced or sold and as a percentage of sales; total value-added (net profit + wages) per tonne of fish sold; and the percentage of the total operational profits, net profits, and value-added made throughout the chain derived from the different links in the value-chain. The questionnaires generated data on sales volumes and values, operational costs and fixed costs, and which allowed for the construction of costs and earnings models for each respondent.

Operational costs were defined as costs which vary depending on the amount of fish being produced. For fish farmers these typically include costs for feed, fertiliser, fry, power, transport, ice, sales commission paid to traders/wholesalers, and labour. For traders/wholesalers and retailers, operational costs typically relate to transport of fish from markets, boxes, labour and ice.

Fixed costs do not vary depending on production volumes. For the fish farming value-chain, they typically include government licences, repair and maintenance costs, rents paid for land and buildings, and the depreciation costs of assets. Depreciation costs have been estimated by obtaining information on the replacement costs of fixed assets, and depreciating these costs over standardised lifespans for different items e.g. buildings over 25 years, nets over 3 years, water pumps over 5 years, generators over 10 years, vehicles over 10 years.

The study outputs generated data on the number of people employed and on the nature of that employment, whether employment is full-time, part-time or seasonal, whether employees are men or women and over or under the age of 30. The data collected were converted into Full-Time Equivalent (FTE) jobs for the various employment categories.

In addition to these quantitative calculations, the focus groups and some sections of the questionnaires allowed for the collection of more qualitative information, particularly on the key factors impacting on value-chain performance and on some potential solutions to these problems.

RESULTS AND DISCUSSION

The farmed fish value-chain

Mapping of the value chain revealed it to be very short and simple with three main actors; producers, wholesaler/traders and retailers (Figure 2). There are virtually no exports or processing of Egyptian farmed fish so almost all the fish is sold in whole form (either live, fresh on ice, or fresh without ice).

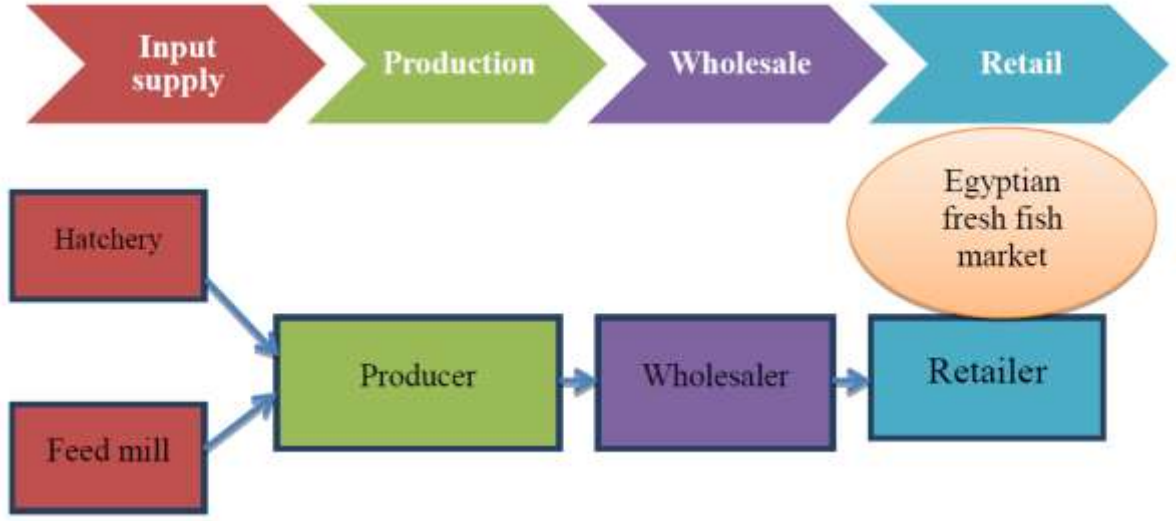

Figure 2. Egyptian Aquaculture Value Chain

Fish is harvested by fish farms, bought by traders/wholesalers who either collect fish from the farms or have fish delivered to them by the fish farms, and then sold on to retailers and restaurants (sometimes, but not often, through a second trader/wholesaler). Some product, especially in Kafr el Sheikh, Behera and Sharkia Governorates, passes through wholesale markets, while other product is transported directly by traders/wholesalers to retailers. It appears that much of the largest size-grade of tilapia (>350 g, known locally as 'super') is sold through the wholesale markets in Kafr el Sheikh, Behera and at El-Obour close to Cairo, while smaller fish may by-pass these markets and be sold closer to the farms, where purchasing power of the local population is weaker, and greater demand for smaller, cheaper fish.

Most fish farms reported that they produce and sell a mix of fish species, dominated by sales of tilapia, but also including sales of mullet, catfish, and carp. The average size of fish being harvested was 265 g for tilapia, 409 g for grey mullet, 216 g for thinlip mullet, and 1,481 g for catfish. Eighty-seven percent of the total volume and 81% of the total value covered by the survey was accounted for by tilapia. Mullet represented 9% of volume and 18% of value, carp 0.2% of volumes and 0.1% of values, and catfish 1.7% of volume and 1.3% of value.

All catfish was sold live, while other species (tilapia, mullet, carp) were generally sold either fresh on ice (in summer months or if markets were relatively far from farms) or fresh with no ice (in winter months or if markets were relatively close to farms). There appears to be a growing trend for the sale of live tilapia, particularly for fish produced in Fayoum Governorate, which is transported in drums or tanks with oxygen by traders to wholesalers and retailers.

Key features of the value-chain included a very short time-period (1-2 days) from harvest to final consumption by the consumer and very low post-harvest losses (in contrast to many wild fisheries value-chains) reflecting an efficient distribution system with production located close to major population centers.

Operational and financial performance

Fish producers

Average operational data for fish farms in the four governorates, and average operational data for the entire sample as a whole are shown in detail in Table 2.

Although most of the interviewees have been involved in fish farming for many years, those from Kafr el Sheikh were, on average more experienced and those from Fayoum, less experienced.

The lowest average farm size was in Fayoum, perhaps because there is a shortage of suitable land for fish farming compared to the three Nile delta governorates.

Stocking densities depended on farming strategies and varied from 14,000 to 70,000 per hectare for tilapia. The average stocking rate in farms in Behera Governorate was the highest compared to other governorates at 45,000 per hectare.

Tilapia represented an average 87% of fish stocked, ranging between 78.7% in Sharkia to 95.4% in Fayoum.

Average production rates (tonnes.ha^{-1}) were highest in Behera. This may be because many of the fish farms included in the Behera sample frame were located close to Lake Idko where there is good water availability.

The average quantity of feed used was 14.3 tonnes per hectare, with highest feed application rates in Behera, and lowest in Sharkia. The best Feed Conversion Ratios (FCRs) were in Behera and Sharkia compared to Kafr el Sheikh and Fayoum.

Relatively low fish prices in Behera were due mainly to the small harvest size of fish (average tilapia size is 235 g) and the relatively high prices in Fayoum were due to the dominance of the live fish trade and the high average size of tilapia at harvest 283 g.

Table 2: Operational data for the fish farming sub-sector

Operational data	Kafr el Sheikh	Behera	Fayoum	Sharkia	Total
Number of farms interviewed	21	13	16	9	59
Years involved in the sector	20	18	16	18	18
Total hectare of interviewed farms under prod'n	223	188	83	143.2	637
Average area under production (ha)	11	14	5	16	11
Average stocking density /ha	34,388	44,972	34,070	33,329	35,864
Tilapia % of stocking rate	88.5%	92.6%	95.4%	78.7%	87.1%
Average size of tilapia when stocking (gr)	10	4	11	10	9.05
Average growth period (months)	9.6	8.7	8.3	7.7	8.7
Average feed used (tonnes / ha)	14.46	15.13	12.41	9.91	13.34
Average production (tonnes / ha)	7.76	11.46	7.53	7.42	8.46
Average FCR	1.86	1.45	1.65	1.34	1.62
Average size tilapia at harvest (gr)	276	235	283	252	265
Average % of total production from tilapia	86%	94%	93%	79%	89%
Average FTE / ha	0.50	0.54	0.91	0.54	0.63
Average FTE / 100 tonne.yr^{-1}	6.99	5.31	12.59	7.98	8.31

Table 3 provides information on the financial performance of the fish farms.

The overall average fish price was around 10 LE/kg (1.68 $/kg), ranging from 8.26 in Behera to 11.79 LE/kg in Fayoum. Higher prices in Fayoum resulted from selling live tilapia, allowing the fish farmers to generate a price premium of around 2 LE/kg higher than other farmers.

Fish farms had positive financial performance in all governorates in terms of average net profits (average LE 247,172), net profits per tonne of fish (average LE 2,329), and net profits as a percentage of sales (average 22%). Fish farmers in Fayoum displayed the highest profits even though they had the highest production cost per tonne, due largely to high prices. Other factors may be the skill level of farmers as they have been the beneficiaries of more training than farmers in other Governorates. In general, farms in Kafr el Sheikh had the worst performance of the four governorates;

The average total production cost across all farms was LE 7,769/tonne ($1,303/tonne), which represents the break-even weighted sales price, so fish should be sold at higher than LE 7,769/tonne if the farm is to make a profit. Highest average production costs were in Fayoum (LE 8,392/tonne) and lowest in Behera (LE 6,688/tonne);

Operational costs per hectare varied between governorates ranging from 68,500 LE/ha in Behera to 45,000 LE/ha in Sharkia. In contrast, operational costs per tonne of fish produced were lowest in Behera, as they produced the highest fish yields (4.81 tonne/ha).

Fish feed represented the largest operational cost (average 67% of operational costs) followed by fish seed (13%), followed by labour (8%), sales commission (5%), and fuel/electricity/power (3%).

Operational costs made up 91.5% of total costs. Fixed costs were low because many farms are on rented land with short lease periods, which decreases the incentive for farmers to invest in fixed assets. Land rents are the highest single fixed cost (average 62% of fixed costs) with depreciation and repair/maintenance costs both contributing 17% of total fixed costs. Very few farms have any formal fixed finance costs in the form of interest payments on loans, as there is virtually no formal bank lending to the sector;

The total value-added by the sub-sector i.e. net profits plus wages paid to labour, was LE 2,989 ($501) per tonne of fish produced with the highest value added in Fayoum and the lowest in Kafr el Sheikh.

Table 3: Financial performance of fish farms

Financial performance data	Kafr el Sheikh	Behera	Fayoum	Sharkia	Overall Average
Average sales price (LE*/kg)	9.70	8.26	11.79	9.87	9.98
Average sales revenue (LE)	804,447	1,385,487	427,841	1,267,517	885,964
Average operational costs (LE)	563,226	1,008,630	286,703	720,814	600,242
Average operational costs / ha (LE)	55,150	68,473	55,301	45,296	55,350
Average feed costs as % of operational costs	72%	66%	68%	57%	67%
Average op. costs / tonne produced (LE)	7,020	6,405	8,011	6,692	7,115
Average operational profit (LE)	253,551	410,652	141,138	546,703	301,357
Average operational profit / tonne (LE)	2,724	2,243	3,402	3,179	2,997
Average fixed costs (LE)	68,612	52,593	13,498	87,933	51,343
Average total production cost (LE/tonne)	8,051	6,688	8,392	7,442	7,769
Average net profit (LE)	182,036	356,410	127,639	458,770	247,172
Average net profit / tonne (LE)	1,640	1,914	3,402	2,429	2,329
Average net profit as % of sales	16%	20%	29%	24%	22%
Average labour costs / tonne produced (LE)	516	486	948	768	660
Average total value-added / tonne (LE)	2,155	2,400	4,350	3,198	2,989

* (LE5.96=$1)

Trader/wholesaler sub-sector – operational and financial performance

Table 4 provides the outputs of the data collected and analysed for trader/wholesaler sub-sector of the value-chain. Traders/wholesalers are key players in the value-chain, especially in terms of determining prices. The one exception to this is in Fayoum, where fish farmers are reported to have a much stronger influence on farm gate prices than in other Governorates. The traders/wholesalers play a key role in providing finance to many of the fish farms (along with feed mills/traders in many cases), and most of them finance their operations out of their own finance (often earned from other economic activities). This provides an indication of the overall financial position/wealth of such individuals, and their influence in the value-chain. Even though final profit margins (3.9% on average) and profits per tonne of fish sold (LE 422) are both low compared to the farming sub-sector, given the large average value of sales made by individuals each year (LE 11.9 million on average), profits in absolute terms were significant, with individuals typically earning around LE 400,000 ($67,114) per year.

The earnings made by traders/wholesalers are generated from a sales commission, 3-6% of fish sales value, which is paid to them by the fish farmers. This margin is typically lower (e.g. 3%) when farmers deliver product to them, and higher (5-6%) if they collect fish from the farms and therefore have to pay for transportation and ice, and if they have provided finance to fish farmers. Individual questionnaire responses revealed that net profits and net profit as percentage of sales were generally higher when traders/wholesalers collected fish from the farms, because the costs they incur on ice and transport are less than the difference between the commission they take for collecting fish at the farms, and the commission they get if fish is delivered to them.

Table 4: Operational and financial performance data for fish traders/wholesalers

	Kafr el Sheikh	Behera	Fayoum	Sharkia	Overall
Operational data					
No. of traders/wholesalers interviewed	6	5	5	6	22
Total annual sales volume of interviewees (tonne)	9,588	7,749	2,697	6,072	25,566
Total annual sales value of interviewees (LE)	105,948,000	75,463,200	36,026,210	51,739,588	269,176,998
Average FTE / '00 tonnes of sales	0.40	0.62	0.92	1.56	0.87
Average sales price (LE/kg)	10.83	9.86	12.95	10.23	10.66
Financial performance					
Average annual sales value (LE)	17,658,000	12,577,200	7,205,242	8,623,265	11,930,954
Average operational costs (LE)	17,158,250	12,172,752	6,800,911	8,226,058	11,510,701
Average operational profit (LE)	499,750	404,448	404,331	397,206	420,254
Average operation profit / tonne (LE)	293	265	822	413	440
Average labour costs / tonne (LE)	42	96	98	91	80
Average fixed costs (LE)	34,454	13,517	9,532	7,918	17,377
Average net profit (LE)	465,296	390,931	394,799	389,288	402,877
Average net profit / tonne (LE)	268	252	804	400	422
Average net profit as % of sales	2.3%	3.7%	6.4%	4.4%	3.9%
Average total value-added / tonne (LE)	310	347	903	491	503

Farm gate fish prices were higher in Fayoum than in other governorates but average annual sales values for individual traders/wholesalers operating within Fayoum were lower than in other Governorates, due to the lower level of total farm production in Fayoum.

Operational costs were comprised almost entirely of fish purchases. Other operational costs included labour, truck rental/transport, ice, and fuel/power, but none of these items made up more than one percent of the value of sales.

Fixed costs were generally very low, and more evenly distributed across a range of items such as rents/leases (32% of total fixed costs), depreciation of buildings, fish boxes and vehicles (30% of fixed costs), and repairs and maintenance of buildings and vehicles (15% of fixed costs).

The individual average earnings for traders/wholesalers across the four governorates were very consistent, with those in Fayoum similar to those in other governorates even though sales volumes and values are lower, due to the higher margins being achieved.

The average value-added (net profits plus wages) per tonne of fish sold was LE 503, and was highest in Fayoum and lowest in Kafr el Sheikh.

Retailer sub-sector – operational and financial performance

There are two main types of farmed fish retailers in Egypt. The first group engage in 'informal' street sales. This is usually carried out by individual operators who purchase fish from wholesale markets or traders, and then set up shop by the roadside to sell their product. Sales facilities and equipment is minimal, often comprising just a shelter from the sun.

Labour is generally not employed, and these types of retailers aim to make LE 0.5-1.0 profit on each kg of fish they sell.

Table 5: Operational and financial performance data for fish retailers

	Kafr el Sheikh	Behera	Fayoum	Sharkia	Overall
Operational data					
No. of retailers interviewed	5	0	6	1	12
Total annual sales value of interviewees (LE)	5,244,300	n/a	4,998,210	1,056,600	11,299,110
Average FTE / 100 tonnes sales	1.34	n/a	7.79	2.02	4.62
Average sales price (LE/kg)	12.51	n/a	15.75	10.67	13.98
Financial performance					
Average annual sales value (LE)	1,048,860	n/a	833,035	1,056,600	941,593
Average operational costs (LE)	972,648	n/a	786,268	974,880	879,644
Average labour costs /tonne (LE)	0	n/a	333	170	181
Average operational profit (LE)	76,212	n/a	46,767	81,720	61,948
Average operation profit / tonne (LE)	916	n/a	1,091	825	996
Average fixed costs (LE)	-	n/a	5,557	4,700	3,170
Average net profit (LE)	76,212	n/a	41,210	77,020	58,778
Average net profit / tonne (LE)	916	n/a	1,008	778	951
Average net profit as % of sales	7%	n/a	6%	7%	6.8%
Average total value-added / tonne (LE)	916	n/a	1,341	948	1,131

The second group is more formalised, with sales taking place from retail shop facilities. These retailers may also have fridges and or freezers for storing unsold fish for following day and often employ labour to clean and prepare fish. As a result their operational and fixed costs tend to be higher than the informal street traders.

The data presented in Table 5 shows that retailers typically have low fixed costs, and a high percentage of operational costs comprising fish purchases (with other operational costs being primarily for transport of fish from markets, and ice). This suggests that as long as retailers can sell their product for a small standard margin over and above the purchase price, there is little 'risk' inherent in the business. The higher fish prices in Fayoum exhibited in earlier links in the value-chain were maintained in the retail sub-sector.

Net profit earnings fluctuated among governorates with the lowest in Fayoum, while Kafr el Sheikh and Sharkia were similar. Average net profit per individual business owner was LE 58,778 ($9,862), still considerably above national average earnings. The retail sub-sector creates an average of LE 1,131 value added for every tonne of fish sold.

Employment creation through-out the value-chain

Table 6 demonstrates that employment was entirely male in the fish farming sub-sector and was fairly evenly divided between those over and under 30 years of age. It was mostly full-time work, and generated 8.3 jobs for each 100 tonnes.yr^{-1} of fish produced.

For the trader/wholesaler sub-sector, employment was also almost exclusively male, even more full-time in nature than in the farming sub-sector, and generated a lower percentage of jobs for the under 30's. The trading/wholesaling sub-sector generates just under 1 FTE job for each 100 tonnes.yr^{-1} of fish being sold.

It is only at the retail sub-sector that any meaningful quantities of female employment were being created. This employment tends to be full-time in nature, and with a low proportion of total employment being for the under 30's. The retail sector created 4.6 jobs per 100 tonnes.yr^{-1} of fish sold.

Every 100 tonnes.yr^{-1} of fish produced by fish farms resulted in almost 14 FTE jobs through the value-chain. Total Egyptian aquaculture pond production was estimated at 716,801 tonnes in 2010, indicating that were a total of almost 100,000 FTE jobs in the sector as a whole. This study did not attempt to estimate multiplier employment impacts from pond farming, or employment from other production methods e.g. cage farming.

Wages paid to those working in the sector were typically around LE 800-900/month ($134-151/month) for full-time labour, and LE 30-50/day ($5-8.4/day) for part-time and seasonal labour.

Table 6: Employment creation in the Egyptian aquaculture value chain

Employment	Full time equivalent jobs per 100 tonnes.yr^{-1} sold				
	Kafr el Sheikh	Behera	Fayoum	Sharkia	Overall Average
farmers	6.99	5.31	12.59	7.98	8.31
traders/wholesalers	0.40	0.62	0.92	1.56	0.87
retailers	1.34	n/a	7.79	2.02	4.62
Total	8.73	5.93	21.29	11.57	13.80
% of FTE days contributed by men					
farmers	100%	100%	100%	100%	100%
traders/wholesalers	100%	100%	100%	94%	98%
retailers	60%	n/a	80%	50%	69%
% of FTE days for full-time employment as opposed to part-time or seasonal work					
farmers	70%	86%	63%	73%	72%
traders/wholesalers	83%	91%	97%	92%	91%
retailers	100%	n/a	100%	100%	100%
% of FTE days contributed by those under 30 years of age					
farmers	71%	41%	52%	56%	57%
traders/wholesalers	35%	52%	36%	28%	37%
retailers	50%	n/a	16%	100%	37%

Fish prices across the value chain

Mapping the value chain and constructing costs and earnings models for each link in the value chain as presented above, allowed for a comparison across the various sub-sectors in the value chain. The average fish prices of products sold by each link in the supply chain in each governorate are summarized in Table 7. This indicates that fish farmers obtained a relatively high percentage of the final price. This is due to the lack of any exports, the short supply chain, and the lack of value-addition through the chain.

Table 7: Fish prices in the farmed fish value-chain

Sub-sector	LE/kg (all species, Average price)					Average price compared to consumer price				
	K el Sh	Beh	Fay	Sha	All	K el Sh	Beh	Fay	Sha	All
farmers	9.70	8.26	11.79	9.87	9.98	78%	n/a	75%	92%	71%
traders/ wholesalers	10.83	9.86	12.95	10.23	10.66	87%	n/a	82%	96%	76%
retailers	12.51	n/a	15.75	10.67	13.98	100%	n/a	100%	100%	100%

Finally, Table 8 provides information on the total value-added created through the value-chain i.e. the net profit, plus the wages earned by those working in the sector. The data show that on average across all governorates, a total of LE 4,619 value-added is generated for each tonne of fish produced by the farming sub-sector. Again, the levels of value-added created were highest in the fish farming sub-sector (LE 2,985/tonne), and those in Fayoum (LE 6,594/tonne) were higher than in other governorates.

Table 8: Value-added in the farmed fish value-chain

Sub-sector	LE/tonne					% total value-added				
	K el Sh	Beh	Fay	Sha	All	K el Sh	Beh	Fay	Sha	All
farmers	2,155	2,400	4,350	3,198	2,989	63.7%	87.4%	66.0%	69.0%	64.7%
traders/wholesalers	310	347	903	491	503	9.2%	12.6%	13.7%	10.6%	10.9%
retailers	916	n/a	1,341	948	1,131	27.1%	n/a	20.3%	20.4%	24.5%
Total	3,381	2,748	6,594	4,637	4,623					

The data presented in Table 7 and 8 serve to benchmark performance by the sub-sectors of the value-chain in different governorates and demonstrate the superior performance of those in Fayoum governorate. The emphasis on live fish trade, on which Fayoum's superior performance appears to be largely based, also seems to be a strategy that is increasingly being pursued in other governorates.

This study did not collect information to allow for a quantitative comparison of the changes in performance within the sub-sectors of the value-chain over time. However there was an attempt to generate some findings of a more qualitative nature by asking interviewees to comment on their perceptions about changes in key variables over the last three years. A relatively uniform picture was provided by respondents in terms of the perceived changes in the operational and fixed costs incurred in the fish farming sub-sector, with a dominant view being that most individual cost items e.g. feed, labour, rents, power, etc., have increased over recent years. Given that fish prices have declined in real terms in recent years, this suggests that profitability has been declining in recent years. Sector performance may now be under threat, especially due to increases in the feed costs, which have increased by 200-250% over the last 6-7 years.

Critical factors impacting on value-chain performance

Critical factors affecting the farmed fish value chain were explored through during the study and classified into three groups; input, production and post harvest and marketing factors.

Critical input factors included; access to credit; high cost of fish feed; poor quality of tilapia fry; poor water quality of inlet water; limited land available for future expansion; and high cost power and fuel.

Critical production factors included; limited growing season for tilapia; farm layout and design; variable knowledge of Best Management Practice (BMP) about feed use and fish health management; low stocking densities; the weak structure of sector and subsector organization; and limited number of cultured species (tilapia and mullet).

Post harvest and marketing critical factors included daily and seasonal price fluctuations due to changes in supply volume; poor health and hygiene in wholesale and retail markets; limited experience and knowledge about export markets; lack of value-addition and processing; and steady increases in fish supply coupled with poor consumer perceptions of farmed fish quality leading to declining consumer prices.

All of these issues represent potential areas for action by stakeholders in the aquaculture value-chain itself and by other relevant actors including government, NGOs and donors. Many of these are now being addressed by the SDC funded IEIDEAS project.

Conclusions

The Egyptian aquaculture sector generates very considerable levels of value-added, results in profitable businesses at each stage of the value-chain, and provides employment for many thousands of people. In spite of that, the sector now faces number of significant challenges. The historical strength of the sector, coupled with recent challenges, and indeed opportunities for further improvements in value-chain performance, provide a strong argument for action by private sector within the value-chain, and by government in the form of supportive policy and legislation. Such action would serve both to safeguard the current financial and employment benefits being generated in the sector, and to increase such benefits in the future. Value-chain analysis has not been widely adopted in the aquaculture sector, with a continuing focus instead in research and interventions on technical production issues. This paper has demonstrated that value chain analysis is a useful tool for understanding the social and economic benefits generated by the aquaculture sector, and for identifying the critical factors affecting its performance. Value chain analysis should be considered as an essential first step in planning necessary action and innovations to bring about sustainable development of this key sector.

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